

CLAIMS:

1. A method of testing audio/video synchronization of a decoder device for receiving a digital stream, said digital stream containing system time clock fields, program clock reference fields, audio decoding time stamp fields, audio presentation time stamp fields, video decoding time stamp fields and video presentation time stamp fields, comprising: recovering at least two sequential program clock references from said program clock reference fields;

calculating a frequency of a device used to encode said digital stream based on said sequential program clock references and decoder time stamps of when said sequential program clock references were recovered;

generating an audio elementary stream and a video elementary stream from said digital stream;

recovering from said audio elementary stream at least one audio decoding time stamp from said audio decoding time stamp fields and calculating a first time difference between said audio decoding time stamp and a first decoder time stamp of when an audio unit corresponding to said audio decoding time stamp was decoded;

recovering from said audio elementary stream at least one audio presentation time stamp from said audio presentation time stamp fields and calculating a second time difference between said audio presentation time stamp and a second decoder time stamp of when an audio unit corresponding to said audio presentation time stamp was presented;

recovering from said video elementary stream at least one video decoding time stamp from said video decoding time stamp fields and calculating a third time difference between said video decoding time stamp and a third decoder time stamp of when a video frame corresponding to said video decoding time stamp was decoded; and

recovering from said video elementary stream at least one video presentation time stamp from said video presentation time stamp fields and calculating a fourth time difference between said video presentation time stamp and a fourth decoder time stamp of when said a video frame corresponding to said video presentation time stamp was presented.

2. The method of claim 1, further including:

storing said calculated frequency , said first time difference, said second time difference, said third time difference and said fourth time difference.

3. The method of claim 2, further including:

storing a decoder time stamp of when said calculated frequency was calculated, said first decoder time stamp, said second decoder time stamp, said third decoder time stamp and said fourth decoder time stamp.

4. The method of claim 3, wherein said storing said calculated frequency, said first time difference, said second time difference, said third time difference and said fourth time difference; and said storing a decoder time stamp of when said calculated frequency was calculated, said first decoder time stamp, said second decoder time stamp, said third decoder time stamp and said fourth decoder time stamp are stored on storage media internal to said decoder device.

5. The method of claim 3, wherein said storing said calculated frequency, said first time difference, said second time difference, said third time difference and said fourth time difference and said storing a decoder time stamp of when said calculated frequency was calculated, said first decoder time stamp, said second decoder time stamp, said third decoder time stamp and said fourth decoder time stamp are stored on storage media external to said decoder device.

6. The method of claim 1, further including:

generating said first, second, third and fourth decoder time stamps based on program clock references recovered from said program clock reference fields of said digital stream.

7. The method of claim 1, further including:

generating said first, second, third and fourth decoder time stamps based on said frequency of said device used to encode said digital stream.

8. The method of claim 1 further including:

comparing said calculated frequency to a known value of said encoder frequency; and
comparing said first time difference to zero, said second time difference to zero, said third time difference to zero and said fourth time difference to zero.

9. A method of testing audio/video synchronization of a decoder device under test, said decoder device receiving a digital stream, said digital stream containing system time clock fields, program clock reference fields, audio decoding time stamp fields, audio presentation time stamp fields, video decoding time stamp fields and video presentation time stamp fields, comprising:

providing a frequency extractor module in a de-multiplexer of said decoder device, said frequency extractor module adapted to recover at least two sequential program clock references from said program clock reference fields;

calculating a frequency of a device used to encode said digital stream based on said sequential program clock references and decoder time stamps of when said sequential program clock references were recovered;

generating an audio elementary stream and a video elementary stream from said digital stream;

providing an audio delta calculator module in an audio decoder, said audio delta calculator adapted module to recover from said audio elementary stream at least one audio decoding time stamp from said audio decoding time stamp fields and adapted to calculate a first time difference between said audio decoding time stamp and a first decoder time stamp of when an audio unit corresponding to said audio decoding time stamp was decoded and adapted to recover from said audio elementary stream at least one audio presentation time stamp from said audio presentation time stamp fields and adapted to calculate a second time difference between said audio presentation time stamp and a second decoder time stamp of when said audio unit corresponding to said audio presentation time stamp was presented; and

providing a video delta calculator module, said video delta calculator module adapted to recover from said video elementary stream at least one video decoding time stamp from said video decoding time stamp fields and adapted to calculate a third time difference between said video decoding time stamp and a third decoder time stamp of when a video frame corresponding to said video decoding time stamp was decoded and adapted to

recover from said video elementary stream at least one video presentation time stamp from said video presentation time stamp fields and adapted to calculate a fourth time difference between said video presentation time stamp and a fourth decoder time stamp of when said video frame corresponding to said audio presentation time stamp was presented.

10. The method of claim 9, further including:

storing said calculated frequency, said first time difference, said second time difference, said third time difference and said fourth time difference; and

storing a decoder time stamp of when said calculated frequency was calculated, said first decoder time stamp, said second decoder time stamp, said third decoder time stamp and said fourth decoder time stamp.

11. The method of claim 9 further including:

comparing said calculated frequency to a known value of said encoder frequency; and comparing said first time difference to a first predetermined value, said second time difference to a second predetermined value, said third time difference to a third predetermined value and said fourth time difference to a fourth predetermined value.

12. The method of claim 11, further including:

modifying said decoder device in response to said calculated frequency differing from a known value of said encoder frequency by a pre-determined amount; and

modifying said decoder in response to said first time difference, said second time difference, said third time difference or said fourth time difference differing from respective said first, second, third and fourth predetermined values by respective predetermined first, second, third and fourth amounts.

13. The method of claim 9, further including removing said frequency extractor module, said audio delta calculator module and said video delta calculator module from said decoder device after testing is complete.

14. The method of claim 9, further including:

generating said first, second, third and fourth decoder time stamps based on program clock references recovered from said program clock reference fields of said digital stream.

15. The method of claim 9, further including:

generating said first, second, third and fourth decoder time stamps based on said frequency of said device used to encode said digital stream.

16. A method of testing audio/video synchronization in a digital stream, said digital stream containing system time clock fields, program clock reference fields, audio decoding time stamp fields, audio presentation time stamp fields, video decoding time stamp fields and video presentation time stamp fields, comprising:

receiving said digital stream in a decoder device having a known degree of audio/video synchronization;

recovering at least two sequential program clock references from said program clock reference fields;

calculating a frequency of a device used to encode said digital stream based on said sequential program clock references and decoder time stamps of when said sequential program clock references were recovered;

generating an audio elementary stream and a video elementary stream from said digital stream;

recovering from said audio elementary stream at least one audio decoding time stamp from said audio decoding time stamp fields and calculating a first time difference between said audio decoding time stamp and a first decoder time stamp of when an audio unit corresponding to said audio decoding time stamp was decoded;

recovering from said audio elementary stream at least one audio presentation time stamp from said audio presentation time stamp fields and calculating a second time difference between said audio presentation time stamp and a second decoder time stamp of when said audio unit corresponding to said audio presentation time stamp was presented;

recovering from said video elementary stream at least one video decoding time stamp from said video decoding time stamp fields and calculating a third time difference between

said video decoding time stamp and a third decoder time stamp of when a video frame corresponding to said video decoding time stamp was decoded; and recovering from said video elementary stream at least one video presentation time stamp from said video presentation time stamp fields and calculating a fourth time difference between said video presentation time stamp and a fourth decoder time stamp of when said video frame corresponding to said audio presentation time stamp was presented.

17. The method of claim 16, wherein said decoder device includes a frequency extractor module adapted to generate said frequency of said device used to encode said digital stream, an audio delta calculator module adapted to generate said first and second time differences and a video delta calculator module adapted to generate said third and fourth time differences.

18. The method of claim 16, further including:
storing said calculated frequency, said first time difference, said second time difference, said third time difference and said fourth time difference; and
storing a decoder time stamp of when said calculated frequency was calculated, said first decoder time stamp, said second decoder time stamp, said third decoder time stamp and said fourth decoder time stamp.

19. The method of claim 16, further including:
generating said first, second, third and fourth decoder time stamps based on program clock references recovered from said program clock reference fields of said digital stream or
generating said first, second, third and fourth decoder time stamps based on said frequency of said device used to encode said digital stream.

20. The method of claim 16 further including:
comparing said calculated frequency to a predetermined frequency; and
comparing said first time difference to a first predetermined value, said second time difference to a second predetermined value, said third time difference to a third predetermined value and said fourth time difference to a fourth predetermined value.